Standard No. S24.810
June 17, 1989
(Revised xx/xx/xxxx)

INCORPORATING DESIGN MODIFICATIONS ON CIRCUIT CARD ASSEMBLIES

1.0 SCOPE

1.1 Scope. This specification provides the general guidelines which should be followed when incorporating modifications such as jumper wires, circuit cuts, added components, etc., on circuit card assemblies which are to be built for NOAA. All stress relief requirements of NHB5300.4(3A-1) for terminations must be adhered to when incorporating any of these modifications.

1.2 Application. The requirements of this standard shall apply to custom equipment developed or fabricated to Government specifications, and to the modification, repair, or rework of those items and commercial production (e.g. off-the-shelf) original equipment manufacturer (OEM) items.

1.3 Contracting Officer's Technical Representative. The Contracting Officer's Technical Representative (COTR) shall provide the final interpretation of any conflict between this standard and specific contract requirements.

1.4 Waivers. Any request for waiver of specific requirements of this standard shall be submitted in writing to the COTR and to the Contracting Officer. A request for waiver must include: a) identification of the paragraphs for which the waiver is requested; b) identification of the systems, equipment, or components for which the waiver is requested; and c) a discussion of rationale for granting the waiver, including impact on reliability, maintainability, schedule, and cost if the waiver is not granted.

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2.0 APPLICABLE DOCUMENTS

2.1 Government documents. The following documents, of the issue in effect on the date of invitation for bid or request for proposal, form a part of this standard to the extent specified herein:

NOAA/NESDIS

Standard.No. S24.801
Preparation of Operation and Maintenance Manuals.

Standard No. S24.802
General Requirements for Ground Electronic Equipment

NOAA/NESDIS standards are available from: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, OSD3, Washington, D.C. 20233.

MIL-STD-454
"Standard General Requirements for Electronic Equipment"

Military specifications and standards are available from: Commanding Officer, U.S. Naval Supply Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

Federal Specifications and Standards are available from: The Superintendent of Documents, U. S. Government Printing Office, -Washington, D.C. 20402.

ANSI Standards are available from: American National Standards Institute, Inc., 1430 Broadway, New York City, New York 10018.

NASA/GSFC specifications are available from: National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt Road, Greenbelt, Maryland 20771.

3.0 MATERIALS USED

M22759/33-30-9	30 AWG Silver Coated Insulated Wire

J-W-1177/14-K2-30	30 AWG Magnetic Wire
M23053/8-002-C	Insulation Sleeving
M23053/8-003-C	Insulation Sleeving
561405-l	Filler
561404-l	Compound - Insulating, Conformal

4.0 TRACE CUTS/DRILLING PLATED THROUGH HOLES

4.1 Traces shall be cut using an X-Acto knife or equivalent, and unless limited by design constraints shall meet the following requirements:

4.1.1 A minimum of .030 inch or conductor shall be removed where the circuit is to be interrupted (see Figure 1).

4.1.2 Conductors shall not be cut or removed within .010 inch of land areas or circuit junctions (see Figure 1).

4.1.3 Once the conductor has been removed, visually inspect the area under the trace to assure that all traces of conductor material has been removed.

4.2 Drilling of plated-through holes (PTH) should be accomplished prior to installation of any components. Once the PTH has been drilled, the hole should be visually inspected to assure that the drilled hole is completely free of conducting material.

5.0 INSTALLATION OF JUMPER WIRES

5.1 Wire Stripping

5.1.1 Wire ends shall be prepared for termination by removing the insulation with thermal wire strippers, for insulated wire, and mechanically stripped using an X-Acto knife, cone strippers, magnetic wire strippers, etc., for magnet wire. The wire strip length should not exceed the amount needed for the required connection.

NOTE: When using thermal strippers, burned or charred insulation is reason for rejection, but a slight discoloration is acceptable.

5.2 Wire Routing

5.2.1 Wires shall be routed in the X and Y directions (diagonal lines shall be avoided) by the shortest practical route and minimize wire crossings. Wires shall not cover plated-through

holes. Wire routing on boards having the same part number shall be routed the same.

5.2.2 Wire shall be secured to the board at least once per inch using staking compound unless they are less than one inch in length. In the event jumper wires must cross, they shall be staked at each intersection using staking compound (see Figure 2).

5.2.3 When a magnet wire is to be routed through a plated hole, the wire shall be insulated with sleeving to avoid shorting to internal traces.

5.3 Wire Termination

5.3.1 When attaching a 30 AWG jumper wire to a component lead, the wire should be wrapped around the lead more than a 1/2 turn, but less than one full turn around the lead.

5.3.2 When attaching a jumper wire to a stud termination the wire shall not be attached closer than 1 lead diameter to the top of the lead (see Figure 3).

5.3.3 Jumper wires attached to round leads that are terminated in plated-through holes shall conform to the requirements of Figure 4. Jumper wires shall be attached such that the wire and resulting solder fillet are not within 0.030 inch of the component body, and not in the stress relief bend of a component lead (reference Figure 4). Jumper wires shall not be placed into a plated-through hole with another lead.

NOTE: The stress relief bend must be free of solder.

5.3.4 For very short jumpers, buss wire may be used and insulted with sleeving if more than 1" in length. When using a buss wire to connect two leads of an I.C. together, the wire may be routed as shown in Figure 5.

5.3.5 When it is absolutely necessary, it is permissible to route a jumper wire over a component body and if necessary (reference 5.6) stake the wire to the component, except on metallic components. Jumpers shall not be routed near or over component leads.

CAUTION: If the component part number, serial number, etc., will be covered, Quality Assurance shall be informed prior to installation.

5.3.6 When lap terminations are made the wire shall overlap the conductor a minimum of .040 inches. The solder joint shall be visually inspected to verify that no cold solder exists in a lap joint (see Figure 6).

5.3.7 Under no conditions shall a wire be terminated to a circuit

trace outside the pad unless the trace is ± .050 inch in width and if the trace width is twice the diameter of the jumper.

5.3.8 When terminating a jumper wire to a cut pin of an I.C. lead staking should be applied between the cut lead and the plated-through hole to prevent any possible shorting to the plated-through hole and providing stress relief for the jumper wire (see Figure 6).

5.3.9 A single wire shall not be used to connect more than two points.

6.0 ADDING COMPONENTS

6.1 Component body spacing to another active component lead should be a minimum of .020, or sleeved, to prevent possible shorting through conformal coating break down due to physical contact. Spacing should also be adequate for thermal dissipation of the affected components.

When jumper wires are attached to components with trimmed leads, the component leads and jumper wires shall conform to the requirements of Figures 7 and 8.

6.2 When adding components to a board or re-routing a component lead, the recommended method for termination of the jumper wire is to form the component lead as a terminal wire (see Figure 8). Do not use the component lead to attach to another component. Requirements for attaching jumper wires to components are shown in Figures 7-11.

6.3 When adding glass bodied or ceramic bodied components, such as resistors *or* diodes unless both leads are soldered into a plated-through hole, the component shall be encased in resilient sleeving and staked using a Solithane/filler compound or equivalent.

CAUTION: Sleeving may affect the dynamic performance in vibration. Bonding with silactic alone may be better.

NOTE: Prior to sleeving the component, Quality Assurance should be notified so that the part number, value, etc., can be verified.

6.4 Added leads must be routed around/away from existing component leads. If a minimum space of .020 inch cannot be maintained, sleeving, shrink tubing or an insulated wire must be used.

6.4.1 After applying the heat shrinkable tubing it should appear

as follows:

A. The sleeve should be tight around the component body.

B. The exterior of the sleeve shall be free from splits or cracks and there should be no evidence of overheating on the sleeve or wire insulation.

C. The sleeve should extend at least two lead diameters beyond the end of the component body.

6.5 All added components including radial components in which both leads are not secured shall be staked using a Solithane/filler compound or equivalent and shall meet the requirements specified in 6.6.

6.5.1 Staking Added Components:

6.5.1.1 The area in which a component or wire is to be staked shall be free of any moisture, grease or residue prior to staking.

6.5.1.2 For components greater than 1/2" in height, the staking material fillet shall be approximately 2/3 of the parts height. For components 1/2" or less in height, the bond fillet shall be, approximately 1/8" in height on the component body (see Figure 12).

6.6 "Piggy backing" of components is acceptable but should only be done when space constraints prohibit installation of the component on the board substrate. The "piggy backed" component shall be secured with Solithane/filler staking compound or equivalent. Body insulation should be provided by sleeving when metallic component housings are involved. Adequate thermal dissipation must also be provided.

Figure – 1

TRACE CUTS

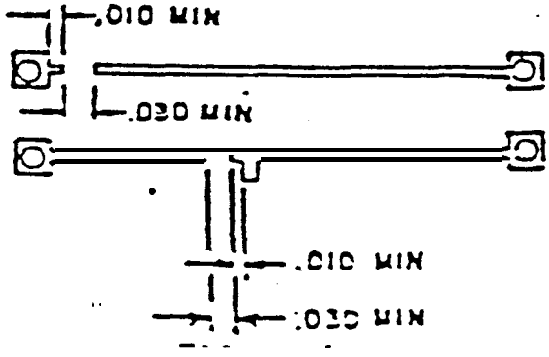


Figure – 2

CROSSED-WIRE STAKING

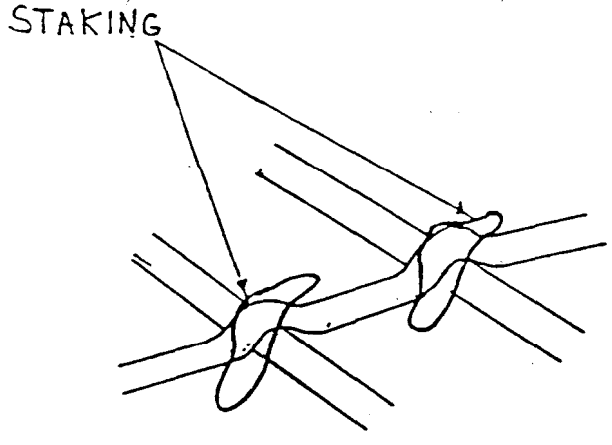


Figure - 3

STUB TERMINATION

Figure - 4

ROUND LEAD IN PLATED-THROUGH HOLE

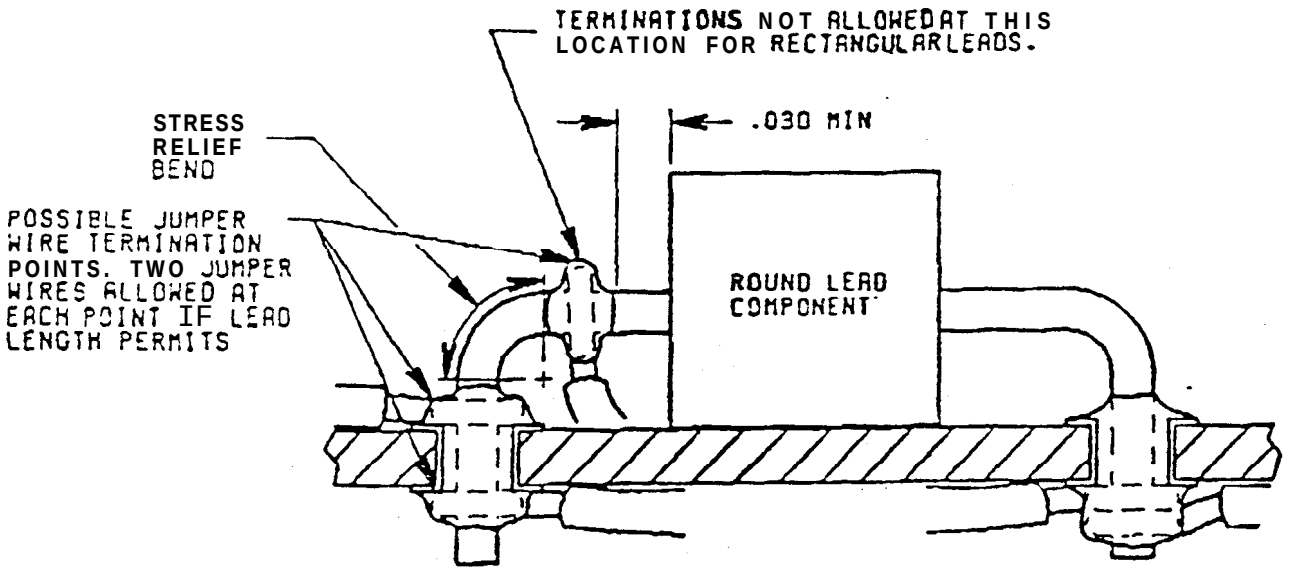


Figura – 5

BUS **WIRE CONNECTION** TO IC **PINS**

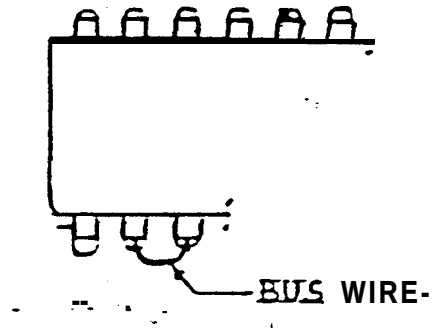


Figure – 6

IC **PIN LAP TERMINATIONS**

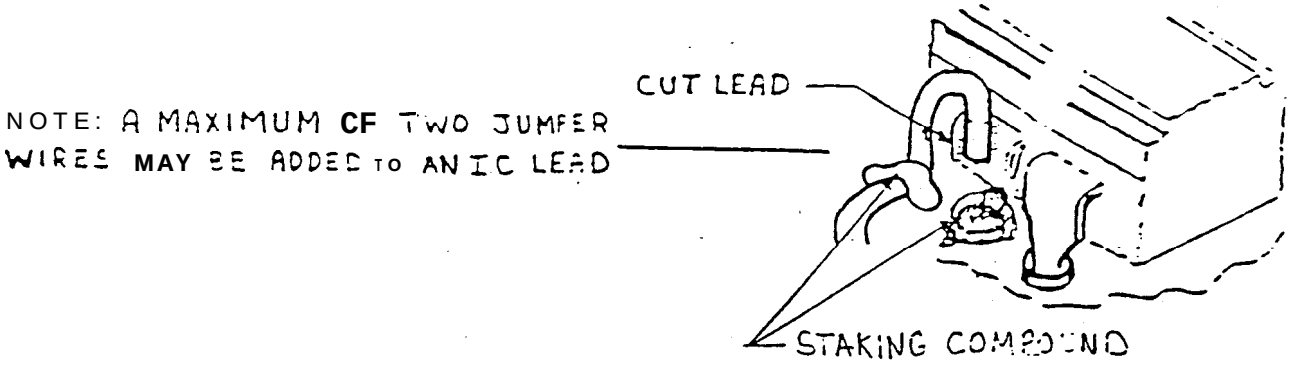


Figure - 7

TRIMMED LEAD TFRMINATIONS

Horizontal component with uniform lead and single hook. (Same dimensions if mounted vertically.)

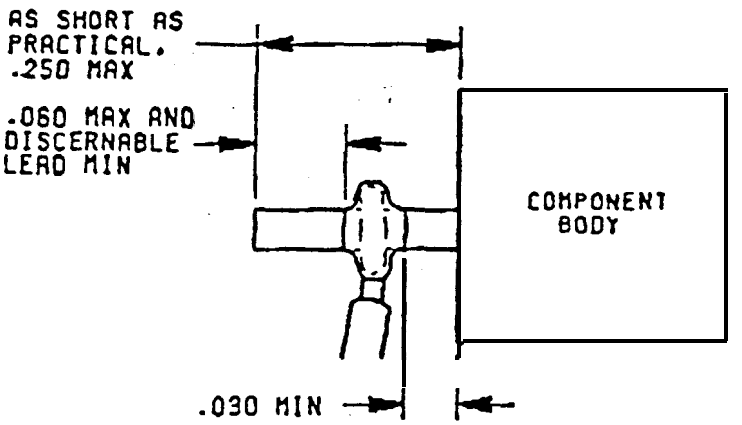


Figure - 8

TRIMMED LEAD TERMINATIONS

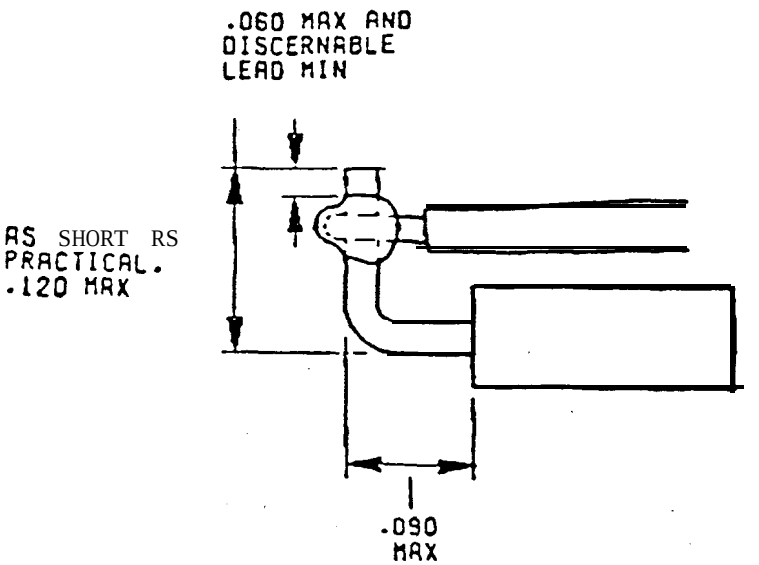


Figure - 9

Examples of Lead Attachment

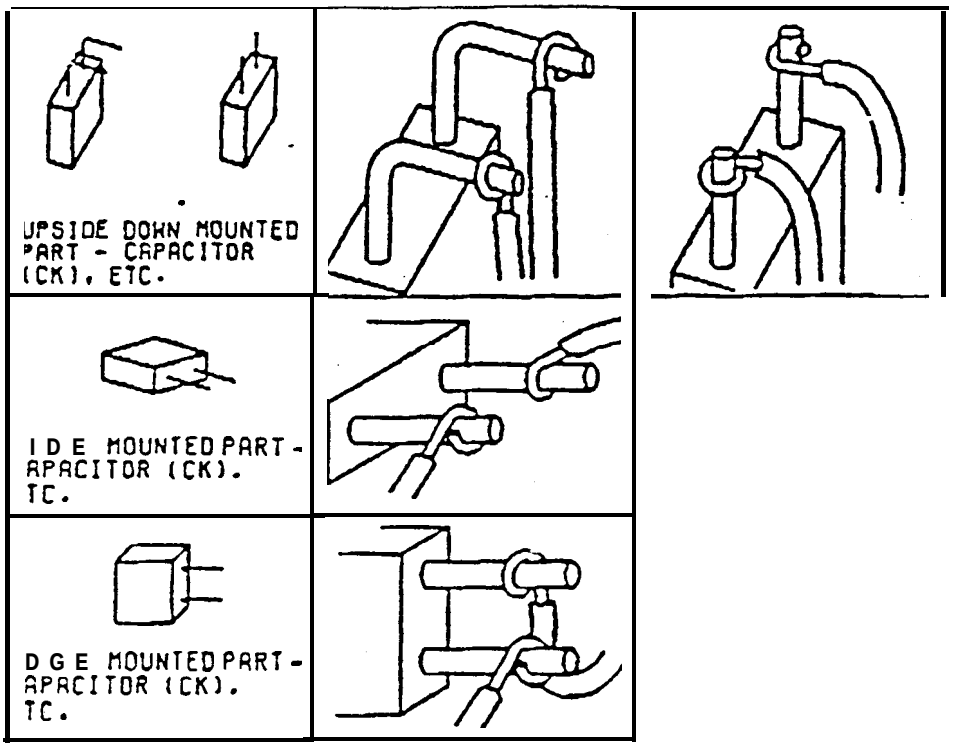


Figure - 10

Examples of Lead Attachment

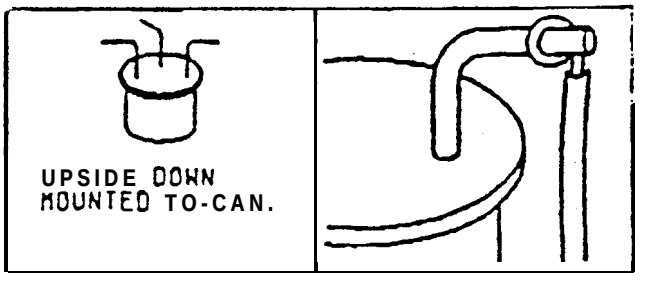


Figure - 11

Examples of Lead Attachment

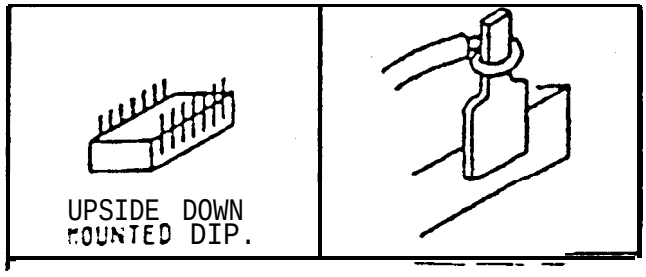
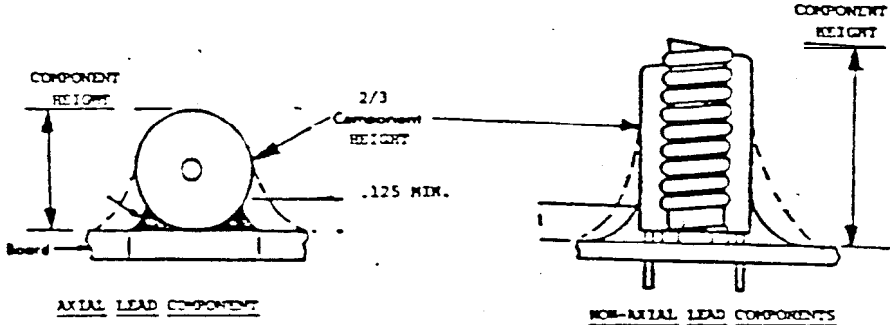


Figure – 12

COMPONENT STAKING



AXIAL LEAD COMPONENT

1) ADHESIVE FILLET ON BOTH SIDES OF COMPONENT.
2) ADHESIVE FILLET COVERS A MINIMUM OF 80% OF COMPONENT LENGTH.

NON-AXIAL LEAD COMPONENTS

1) ADHESIVE FILLET AROUND ENTIRE BODY OF COMPONENT.